THAT WHICH IS CLAIMED IS:

1. A cryogenic accumulator for collecting polarized noble gases, comprising:

a primary flow channel having opposing first and second ends configured to direct polarized gas therethrough;

an outer sleeve positioned around said primary flow channel, said outer sleeve having a closed end defining a collection chamber positioned below said primary flow channel second end; and

a secondary flow channel positioned intermediate of said primary flow channel and said outer sleeve, said secondary flow channel having a closed end positioned in close proximity to said primary flow channel second end.

2. A cryogenic accumulator according to Claim 1, said secondary flow channel having a cylindrically shaped inner wall, wherein said inner wall defines said primary flow channel.

3. A cryogenic accumulator according to Claim 2, said secondary flow channel having an outer wall, wherein said outer wall and said outer sleeve define a buffer gas exit channel therebetween.

4. A cryogenic accumulator according to Claim 1, wherein said primary flow channel second end is a nozzle.

5. A cryogenic accumulator according to Claim 2, further comprising first and second isolation valves in communication with said primary flow channel and said buffer gas exit channel.

6. A cryogenic accumulator according to Claim 4, wherein said first isolation valve is positioned at the first end of said primary flow channel to control the flow of a target gas therethrough.

7. A cryogenic accumulator according to Claim 5, wherein said second isolation valve is positioned spaced-apart from said outer sleeve closed end along said buffer gas exit channel to releasably seal and control the release of gas therethrough.

8. A cryogenic accumulator according to Claim 1, further comprising a secondary flow channel inlet and vent port, and a conduit in fluid communication with said inlet, wherein said conduit extends along a major portion of said secondary flow channel to thereby direct the flow of a warming gas to a predetermined area of said primary flow channel.

9. A cryogenic accumulator according to Claim 1, in combination with a hyperpolarizer unit, wherein said accumulator is configured to detachably release from said hyperpolarizer unit.

10. A cryogenic accumulator according to Claim 1, wherein said secondary flow channel is separate from said primary flow channel.

11. A cryogenic accumulator according to Claim 1, wherein said secondary flow channel is configured as a heat source which is operably associated with said primary flow channel.

12. A cryogenic accumulator according to Claim 11, wherein said secondary flow channel is a heating jacket configured to circulate a gas therethrough.

13. A cryogenic accumulator according to Claim 2, wherein said secondary flow channel includes a longitudinally extending conduit configured to direct a gas to said secondary flow channel closed end adjacent said second end of said primary flow channel.

14. A cryogenic accumulator according to Claim 11, further comprising at least one permanent field magnet positioned adjacent said collection chamber.

15. A cryogenic accumulator according to Claim 12, further comprising a cryogenic refrigeration source operably associated with said collection chamber.

16. A cryogenic accumulator according to Claim 12, wherein said secondary flow channel is configured to circulate ambient temperature gaseous nitrogen therethrough.

17. A cryogenic accumulator according to Claim 12, said accumulator further comprises at least one secondary flow channel vent in communication with said secondary flow channel.

18. A cryogenic accumulator according to Claim 17, further comprising a flow adjustment valve operably associated with said vent to adjust the flow of a gas therein thereby adjusting the heat supplied to at least a portion of said primary flow channel.

19. A cryogenic accumulator according to Claim 1, wherein said outer sleeve, said secondary flow channel, and said primary flow channel are radially aligned along a major portion of the length of said accumulator.

20. A heating jacket for a refrigerated accumulator, comprising:

an outer wall having opposing first and second ends;

an inner wall having opposing first and second ends, said inner wall being spaced apart from said outer wall, wherein said inner wall is configured to be in close proximity to a polarized gas collection path;

a bottom sealed to each of said outer and inner wall second ends;

a top sealed to each of said outer and inner wall first ends, wherein said top, bottom, and inner and outer walls define at least one enclosed fluid circulation channel therebetween;

a fluid inlet in communication with said circulation channel;

a fluid vent configured in communication with said circulation channel;

a heat source comprising a gas, wherein said fluid inlet and vent are configured to allow flow of the gas in said circulation channel.

21. A heating jacket according to Claim 20, wherein said fluid inlet is operably associated with a valve, and wherein said valve provides an adjustable flow rate of the gas in said circulation channel.

22. A heating jacket according to Claim 20, wherein said inner and outer walls are substantially cylindrical and radially aligned.

23. A heating jacket according to Claim 20, said inner wall circumferentially extends around a center opening to define a flow channel therethrough for a polarized gas.

24. A heating jacket according to Claim 21, wherein said inner wall includes a first portion defining a flow channel first diameter, and a stepped down second portion defining a flow channel second diameter, said second diameter being smaller than said first diameter.

25. A heating jacket according to Claim 24, wherein said stepped down portion defines a flow channel nozzle.

26. A heating jacket according to Claim 20, further comprising an elongated conduit positioned in said enclosed circulation channel and operably associated with said fluid inlet.

27. An accumulator for collecting a polarized gas, comprising:

a primary flow channel having opposing inlet and exit ends, said exit end configured as a flow nozzle, wherein said inlet end is detachably connected to a polarized gas collection path; and

an outer sleeve including a collection reservoir aligned with and positioned adjacent to said flow nozzle.

28. An accumulator according to Claim 27, further comprising a heat source positioned intermediate of said primary flow channel and said outer sleeve before said collection chamber, said heat source arranged to provide heat to said flow nozzle.

29. An accumulator according to Claim 27, wherein said heat source comprises an enclosed heating jacket positioned inside of and spaced-apart from said outer sleeve.

30. An accumulator according to Claim 29, wherein said enclosed heating jacket includes a circumferentially extending inner wall which defines said primary flow channel.

31. An accumulator according to Claim 30, wherein said enclosed heating jacket includes a circumferentially extending outer wall spaced-apart from said inner wall which together with said outer sleeve defines an exit path in communication with said primary flow path.

32. An accumulator according to Claim 28, wherein said heat source includes a conduit for directing a flow of a predetermined gas to said flow nozzle.

33. An accumulator according to Claim 30, wherein said enclosed heating jacket includes a vent port, and wherein said heating jacket is configured to circulate gas to conductively heat said inner wall and capture the gas and return it to said vent port.

34. A method for collecting polarized noble gases, comprising the steps of:

directing a gas mixture comprising a polarized noble gas and a second gas along a collection path and into an accumulator;

receiving the gas mixture into the accumulator positioned in the collection path, the accumulator having an inlet channel, a collection reservoir, and an exit channel;

cooling the collection reservoir to temperatures below the freezing point of the polarized noble gas;

trapping polarized noble gas in a substantially frozen state in the collection reservoir;

passing the remainder of the gas mixture including the second gas into the exit channel; and

heating a portion of the inlet channel in the accumulator to facilitate the flow of the gas mixture therethrough.

35. A method according to Claim 34, wherein said heating step comprises the steps of:

introducing a gas separate from the gas mixture to heat a predetermined area of the inlet channel, the separate gas being contained apart from the inlet and exit paths, and the collection reservoir;

circulating the gas separate from the gas mixture about a portion of the inlet path to provide conductive heat to selected portions of the inlet path and reduce the likelihood of blockage along the inlet path attributed to said exposing step.

36. A method according to Claim 34, wherein said directing step includes flowing the gas mixture through a directional nozzle into the collection reservoir.

37. A method according to Claim 34, wherein said cooling step includes immersing the bottom reservoir into a liquid cryogen bath.

38. A method according to Claim 34, wherein said heating step is provided by the steps of:

circulating room temperature nitrgen gas around the outside of at least a portion of the inlet channel; and

capturing the nitrogen gas and venting to atmosphere away from the frozen accumulated noble gas.

39. A method according to Claim 35, wherein said heating step is an adjustable heating step whereby the heat supplied is increased or decreased by adjusting the rate of flow of the circulating gas.

40. A method according to Claim 34, further comprising the steps of: accumulating polarized noble gas in the collection reservoir; and exposing the gas to a magnetic field during accumulation.

41. A method according to Claim 40, further comprising the steps of: detaching the accumulator from a portion of the collection path; and transporting the accumulator with frozen polarized gas in the presence of a magnetic field to a remote site.

42. A method according to Claim 35, wherein said polarized gas is ^{129}Xe.

43. A method according to Claim 34, wherein said gas mixture comprises Xenon and an enriched amount of ^{129}Xe, and wherein less than about 3.5% of the isotope ^{131}Xe is in said gas mixture.

44. A method of thawing frozen polarized gas, comprising the steps of:

providing a sealed container having an interior flow path and a collection chamber, the collection chamber holding frozen polarized gas therein;

exposing the frozen polarized gas to a magnetic field;

heating a portion of the interior flow path adjacent the collection chamber; and

heating the exterior of the sealed container.

45. A method according to Claim 44, further comprising the step of liquefying a substantial portion of the frozen polarized noble gas during thawing.

46. A method according to Claim 45, wherein the sealed container is operatively associated with a pair of isolation valves, and the step of liquefying is

carried out by closing the valves and allowing the pressure in the container to rise to a predetermined level during said heating steps.

47. A method according to Claim 46, further comprising the steps of:

opening at least one of the valves to decrease the pressure in the container causing the liquified gas to become gaseous; and

directing the flow of the gas to a receptacle.

48. A method according to Claim 44, wherein said interior heating step is initiated before said exterior heating step.

49. A method according to Claim 44, wherein said polarized gas comprises ^{129}Xe.

50. A method according to Claim 44, wherein said interior heating step comprises conductively heating the interior flow path by circulating a gas in a contained chamber positioned adjacent the interior flow path.

51. A method according to Claim 50, wherein said gas is directed towards a bottom of the interior flow path above the collection chamber through a conduit.

52. A method according to Claim 44, wherein a single patient dose amount of the polarized gas is thawed in less than 10 seconds.

53. A method according to Claim 45, wherein the polarized gas retains about 30% or more of its initial polarization upon thawing.

54. A method of extending the useful polarization life of a polarized gas product, comprising the steps of:

providing a magnetic field;

freezing a polarized gas in the presence of a magnetic field;

sealing the polarized gas in a containment device;

thawing the polarized gas in the presence of a magnetic field; and

converting a substantial quantity of the frozen gas directly into a liquid phase in the sealed container during said thawing step.

55. A method according to Claim 54, further comprising the step of depressurizing the containment device causing the liquid to become gaseous.

56. A method according to Claim 55, wherein said depressurizing step is carried out by opening the containment device to a collection vessel.

57. A method according to Claim 54, wherein said thawing step is carried out by heating both the exterior of the containment device and a portion of the interior of the containment device.

58. A method according to Claim 54, wherein said containment device is configured to hold a single patient dose, and wherein said thawing step takes less than about ten seconds.

59. A method according to Claim 58, wherein said thawing step takes less than about six seconds.

60. A method according to Claim 54, wherein after said thawing step the polarized gas retains greater than about 30% of the amount of polarization the polarized gas had prior to said freezing step.

61. A method according to Claim 54, wherein the containment device includes an interior nozzle which directs the flow of polarized gas into the bottom of the container during a filling operation, and wherein said thawing step includes heating the interior nozzle to facilitate rapid phase change of a substantial quantity of the frozen polarized gas to a liquid polarized gas.

62. A method according to Claim 54, wherein said freezing step is performed at a first site and said converting step is performed at a second site remote from the first site.

63. A method according to Claim 62, further comprising a transporting step after said freezing step and before said converting step, wherein the frozen polarized gas has an associated relaxation time T1, and wherein said transporting step transports the containment vessel to the second site prior to the expiration of the T1 time period.

64. A method of thawing frozen polarized gas, comprising the steps of:

providing a sealed container having an interior flow path and a collection chamber, the collection chamber holding frozen polarized gas therein;

exposing the frozen polarized gas to a magnetic field;

heating the exterior of the sealed container; and

liquefying a substantial portion of the frozen polarized noble gas during thawing.

65. A method according to Claim 64, wherein the sealed container is operatively associated with a pair of isolation valves, and the step of liquefying is carried out by closing the valves and allowing the pressure in the container to rise to a predetermined level during said heating step.

66. A method according to Claim 65, further comprising the steps of:

opening at least one of the valves to decrease the pressure in the container causing the liquefied gas to become gaseous; and

directing the flow of the gas to a receptacle.

67. A method according to Claim 64, wherein said polarized gas is ^{129}Xe.

68. A method according to Claim 64, wherein a single patient dose amount of the polarized gas is thawed in less than 10 seconds.

69. A method according to Claim 64, wherein the polarized gas retains at least 30% of its initial polarization level upon thawing.

70. A pharmaceutical polarized ^{129}Xe gas product having an initial collection polarization level and a post-freeze gas polarization level, such that the gas polarization level is at least 30% of the initial polarization level.

71. A pharmacological hyperpolarized ^{129}Xe noble gas product, said product having a polarization level at delivery to a user of above 10% and having less than about 10 parts per billion of alkali metal therein, wherein said ^{129}Xe hyperpolarized product is hyperpolarized by optically pumping alkali metal with a gas mixture comprising ^{129}Xe and a reduced amount of the isotope ^{131}Xe, subsequently freezing a predetermined amount of said optically pumped hyperpolarized ^{129}Xe noble gas in the presence of a magnetic field, and converting a substantial portion of the frozen hyperpolarized ^{129}Xe directly from the frozen state into a liquid state.

72. A polarized noble gas product according to Claim 71, wherein said optically pumped gas mixture includes less than about 0.1% ^{131}Xe.